Time-Dependent Phase-Space Measurements of the Longitudinally Compressing Beam in NDCX-I*

S.M. Lidia, G. Bazouin, P.A. Seidl

The Neutralized Drift Compression Experiment (NDCX-I) generates high intensity ion beams to explore Warm Dense Matter physics. A ~150 kV, ~500 ns modulating voltage pulse is applied to a ~300 kV, 5-10 μs, 25 mA K+ ion beam across a single induction gap. The velocity modulated beam compresses longitudinally during ballistic transport along a space charge neutralizing plasma transport line, resulting in ~3A peak current with ~2-3 ns pulse durations (FWHM) at the target plane. Transverse final focusing is accomplished with a ~8 T, 10 cm long pulsed solenoid magnet. Time-dependent electrostatic focusing in the induction gap, and chromatic aberrations in the final focus optics limit the peak fluence at the target plane for the compressed beam pulse. We report on time-dependent phase space measurements of the compressed pulse in the ballistic transport beamline, and measurement of the time-dependent radial impulses derived from the interaction of the beam and the induction gap voltage. We present results of start-to-end simulations to benchmark the experiments. Fast correction strategies are discussed with application to both NDCX-I and the soon to be commissioned NDCX-II accelerators.

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